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Request for grant of a patent

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1. Your reference — AW/SEB/P/75823.GB/B

2. Patent application number *(The Patent Office will fill in this part)* — 0226867.0 — 19 NOV 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)* — INCRO LIMITED
35 Fairfield Rise
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Stourbridge
West Midlands
DY8 3PQ

Patents ADP number *(if you know it)* — 6463632001

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention — OUTLET DEVICE FOR A CONTAINER

5. Name of your agent *(if you have one)* — WILSON GUNN SKERRETT
CHARLES HOUSE
148/9 GREAT CHARLES STREET
BIRMINGHAM B3 3HT
UNITED KINGDOM

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Patents ADP number *(if you know it)* — 7710734001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
United Kingdom	0219641.8	23 August 2002

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if*

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11. I/We request the grant of a patent on the basis of this application.

Signature: Wilson Gunn Signed — Date: 19 November 2002

12. Name and daytime telephone number of person to contact in the United Kingdom: Dr A Wells 0121 236 1036

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OUTLET DEVICE FOR A CONTAINER

This invention relates to an outlet device for a container. More particularly, but not exclusively, this invention relates to a nozzle arrangement which is adapted to be fitted to an outlet of a container to actuate and control the release of the contents stored in said container.

Nozzles are commonly used in conjunction with pressurised containers, such as a so-called "aerosol canister", to actuate and control the release of a product contained therein. Additionally, pump or trigger nozzle devices are also widely used to actuate and control the release of a wide range of products from non-pressurised containers.

Known nozzle arrangements typically comprise a manually operable actuator, the operation of which triggers the ejection of the contents stored in the container. In addition, known nozzle arrangements typically comprise an inlet through which, the contents of the container to which the nozzle is fitted access the nozzle arrangement following actuation, an outlet through which the contents of the container are ejected from the nozzle arrangement following actuation, and an internal passageway through which the contents of the container flow from the inlet to the outlet.

Following the use of the nozzle arrangement it is common for a proportion of the product to remain within the internal passageway of the nozzle arrangement. This can be a particular problem when the product dispensed through the nozzle is a food product (such as cream, sauces etc.), a

cosmetic or pharmaceutical cream or lotion, or an expandable product such as hair mousse, shaving foam etc., because the product retained in the nozzle tends to leak out of the outlet over time. As a result, there is a tendency for the product to adhere to and block the outlet, and either drip down the side of the container or drip onto the surface on which the container is placed. In addition to creating a mess, this leakage can be a particular problem with products that degrade over time, or products that are prone to microbial contamination. Furthermore, certain products tend to dry out and harden following prolonged exposure to air. This can cause the formation of a hardened residue that can be difficult to remove and could cause the internal passageway and/or outlet of the nozzle arrangement to become blocked.

The problem of leakage occurring from the nozzle following use can arise just by virtue of the effect of gravity causing the product that remains in the internal passageway to flow out of the nozzle arrangement. However, leakage is especially prevalent when the product that is being dispensed through the nozzle arrangement is an expandable product, such as shaving foam or hair mousse, because the proportion of the product which remains within the internal passageway after use tends to expand over time and this effect causes at least a proportion of the product present in the internal passageway to invariably leak out of the outlet of the nozzle arrangement.

One approach to achieve this objective is to provide a cleanable nozzle arrangement. Examples of such nozzle arrangements are described in WO

97/31841 and WO 01/89958, the entire contents of which are incorporated herein by reference. These nozzle arrangements enable the internal passageway to be accessed for cleaning after use, thereby enabling any product remaining in the internal passageway to be removed. However, it is neither practicable nor convenient to clean the nozzle arrangement after each instance it is used.

For this reason, it is an object of the present invention to provide a nozzle arrangement constructed so that the problems caused by any product remaining in the internal passageway after use is obviated or at least minimised.

As a result of investigations to develop a solution to the aforementioned problems, a pressure sensitive outlet device was developed which could be used in a whole range of applications, including its use as a nozzle arrangement. Hence, according to a first aspect of the present invention there is provided a pressure-sensitive outlet device adapted to be fitted to an outlet of a container having contents stored therein, said outlet device being configured to enable the contents of said container to be dispensed though said outlet device under pressure and comprising:

(i) an inlet through which the contents of said container access said outlet device during use;

(ii) an outlet through which the contents of said container are ejected from said outlet device during use;

(iii) an internal passageway which connects said inlet to said outlet such that said contents flow through said passageway from said inlet to said outlet during use;

wherein at least a portion said passageway is provided with a resiliently deformable wall, said wall being configured to reside in a position in which said passageway is closed when the device is not in use and to resiliently deform to form an open passageway during use when the contents of the container are caused to flow through said passageway under pressure.

The outlet device of the present invention is, in effect, a pressure sensitive outlet valve which enables the contents of a container to pass through the internal passageway of the device under pressure. However, when the requisite pressure is not applied, i.e. when the device is not in use, the internal passageway is closed by the resiliently deformable wall.

It shall be understood that by "pressure-sensitive outlet device " it is meant a device which allows the contents of a container to flow through the device only when a certain amount of pressure is applied to force the contents through the device. The amount of pressure required to cause flow through the device could be manipulated as desired by varying the resilience provided by the resiliently deformable wall of the internal passageway. This can be achieved by selecting the most appropriate materials and configuration of the resiliently deformable wall to achieve this function.

It must also be appreciated that by "resiliently deformable" we mean that the wall resides in a position in which the internal passageway is closed when no pressure, or insufficient pressure, is applied to cause the contents to flow through the internal passageway, but can deform to provide an open internal passageway when the contents are caused to flow through the internal passageway under pressure.

The container and/or the outlet device must be provided with a means for applying pressure to cause the contents of the container to flow through the outlet device. The pressure required could simply be the pressure of gravity which causes the contents of the container to flow through the outlet device, for example, when the container provided with the outlet device is turned upside down. Alternatively, the container could be provided with collapsible or "squeezable" walls that can be either collapsed or squeezed by manually or mechanically pushing the walls of the container inwards. However, in most cases the container will be a pressurised container provided with an outlet valve that can be selectively opened to cause the contents of the container to flow through the device.

As previously stated, a particular preferred form of outlet device of the present invention is a nozzle arrangement. Therefore, according to a second aspect of the present invention there is provided a nozzle arrangement suitable for use in actuating and controlling the release of the contents of a container, said nozzle arrangement comprising:

(i) an inlet through which the contents of said container access said nozzle arrangement during use;

(ii) an outlet through which the contents of said container are ejected from said nozzle arrangement during use;

(iii) an internal passageway which connects said inlet to said outlet such that said contents flow through said passageway from said inlet to said outlet during use; and

(iv) a manually operable actuator, said actuator being configured, upon operation, to cause the contents of the container to access said inlet and flow through said passageway and be ejected through said outlet under pressure;

wherein at least a portion said passageway is provided with a resiliently deformable wall which is configured to resiliently deform to form an open passageway during use when the contents of the container are caused to flow through said passageway under pressure and to close said passageway when said nozzle arrangement is not in use.

The nozzle arrangements of the present invention have been found to solve the aforementioned problems associated with known nozzles. Specifically, the provision of an internal passageway which can be opened while a product is being dispensed through the nozzle arrangement, and closed when the nozzle arrangement is not in use, provides a means by which any product that remains within the internal passageway after use can be displaced

from the internal passageway. In practice, this occurs as soon as the actuation of the release of the contents of the container has finished and the resiliently deformable wall returns to the position in which the passageway is closed (thereby displacing any product present in the internal passageway). As a result, the last portion of the material dispensed through the outlet is the portion which would typically remain in the internal passageway of a conventional nozzle arrangement. The majority of the material forced out by the resiliently deformable wall will exit through the outlet, but a small proportion of the product may also be pushed back towards the container.

In addition, there are further advantages associated with the nozzle arrangements of the present invention because the closure of the internal passageway after use provides a substantially airtight seal which prevents any contents of the container that might remain in the internal passageway being exposed to the air and/or microbial contamination. If the contents of the container are, for example, food products or creams or lotions, the formation of a substantially airtight seal can prevent the product from degrading or "going off". In addition to improving the quality of the product ejected through the nozzle arrangement during a subsequent use of the nozzle arrangement, this can also reduce any the occurrence of any adverse smell that may be generated by the degrading product.

Furthermore, because there will usually be virtually no product remaining in the internal passageway of the nozzle arrangements of the present

invention, there will not be a sufficient amount of any expandable product remaining in the nozzle which could, following expansion, leak out of the nozzle arrangement.

It shall be appreciated that the term "container" is used herein to denote any container in which the contents or product that is to be dispensed through the outlet device or nozzle arrangement can be stored, and which comprises an outlet through which the contents can be ejected. In most cases, the container will be a typical container or bottle having a body which defines an interior in which contents can be stored an outlet through which the contents can be ejected from the container. However, the term "container" used herein also includes less conventional containers in which the contents to be dispensed may be stored, such as a pipe (e.g. a garden hosepipe), or any other shaped article having an outlet which may contain the contents to be dispensed through the outlet device or nozzle arrangement.

The nozzle arrangement of the present invention may be any suitable form of nozzle arrangement. For example, the nozzle arrangement may be a pump or trigger device which is adapted to be fitted to a non-pressurised container. In such cases, the actuator of the nozzle arrangement is the pump or trigger. The operation of the pump or trigger causes the contents of the container to nozzle arrangement to be dispensed through the nozzle arrangement under pressure. In most cases, however, the container will be a pressurised container, such as a pressurised aerosol canister, and the nozzle

arrangement will be adapted to fit to an outlet valve of the container and actuate the release of the product stored in the container. Such nozzle arrangements have an actuator which is configured to selectively engage with an outlet valve of the container. Where the container is an aerosol canister, it is preferable that the nozzle arrangement is in the form of a spray-through cap. Examples of spray-through cap nozzle arrangements are described in WO 97/31841 and WO 01/89958.

It is an essential feature of the present invention that the internal passageway has a resiliently deformable wall. In certain embodiments of the present invention, it could be the entire wall or walls of the internal passageway which are resiliently deformable. Alternatively, it may be just a portion of the wall. Preferably, the resiliently deformable wall extends over the entire length of the internal passageway or at least a substantial part of the length thereof.

The elasticity/resilience of the resiliently deformable wall may vary along the length of the internal passageway or, alternatively, it may be uniform along the length of the passageway.

It is also preferred that the nozzle arrangement is formed of at least two separable parts, each of said parts having and abutment surface which, when brought into contact with one another, define therebetween at least a portion of the internal passageway of the nozzle arrangement. It is especially preferred that the entire internal passageway together with the outlet and a portion of the inlet are defined between the abutments surfaces of the at least two parts.

Examples of such nozzle arrangements are also described in WO 97/31841 and WO 01/89958 referred to above. This construction enables the abutment surfaces to be separated to expose the internal passageway for cleaning if so desired. In this regard, although the necessity for cleaning is reduced because the amount of product retained in the internal passageway will be virtually negligible, there may still be some residue remaining, especially after prolonged use, so it will still be desirable to be able to clean the internal passageway periodically to prevent any such build up of residue occurring.

A first part of the nozzle arrangement is preferably formed of a rigid moulded plastic material, such as, for example, polypropylene, and the abutment surface of the first part is preferably provided with a groove which, when contacted with the abutment surface of the second part, forms a portion of the wall of the internal passageway. The abutment surface of second part of the nozzle arrangement forms the resiliently deformable wall of the internal passageway when the abutment surfaces of the first and second parts are contacted together. Preferably, a resiliently deformable protruding ridge is provided on the abutment surface of the second part and is shaped so that, when the abutment surfaces of the first and second parts are brought together to form the nozzle arrangement, the ridge is received within and abuts the surface of the groove provided in the abutment surface of the first part. It is preferable that no gaps are present between the surface of the ridge and the groove of the first channel. As a consequence of the aforementioned construction, it will be

appreciated that the internal passageway defined between the abutment surfaces of the first and second parts is closed. The protruding ridge on the abutment surface of the second part of the nozzle arrangement preferably extends along the entire length of the groove formed on the abutment surface of the first part. The ridge shaped protrusion may be made from any suitable resiliently deformable material which can be moulded into the necessary form to be received directly adjacent to the surface of the groove defined of the abutment surface of the first part. Suitable examples of such materials include various types of resiliently deformable rubber, or soft flexible plastic materials, such as flexible polypropylene or flexible polyethylene. The entire second part of the nozzle arrangement may be formed of the same material or, alternatively, may be formed from a different material, such as a rigid moulded plastic (e.g. polypropylene), with just the ridge protrusion being provided in the second part as an insert formed of resiliently deformable material.

During use, the contents of the container are caused to flow through the nozzle arrangement by the operation of the actuator. The operation of the actuator causes the contents to flow into the inlet of the nozzle arrangement under pressure and enter the internal passageway. This causes the resiliently deformable wall of the internal passageway formed by the ridge protrusion provided on the abutment surface of the second part of the nozzle arrangement to deform in such away that it becomes displaced from the wall defined by the groove formed on the abutment surface of the first part of the nozzle

arrangement. As a consequence, the internal passageway is effectively caused to open, thereby enabling the contents of the container to flow through the internal passageway and be ejected through the outlet of the nozzle arrangement. Once the operator ceases the actuation of the release of the contents of the container, then the resiliently deformable wall of the internal passageway returns to its original position where the internal passageway is effectively closed (i.e. the ridge protrusion provided on the abutment surface of the second part is received within and contacts the surface of the groove formed on the abutment surface of the first part). This recoil of the resiliently deformable wall to its original position causes any product which remains in the internal passageway at the time when the actuation has ceased to be forced to flow out through the outlet. In practice, a small proportion the contents of the container that are present in the internal passageway once the actuation has finished will be forced back into the inlet of the nozzle arrangement.

In certain embodiments of the invention, the first part of the nozzle arrangement will be a lower part which fits to the container and to which the second part is fitted to form a "lid" or upper part. The lid or upper part may be small, i.e. just covering the top of the internal passageway or may be large so as to cover all or the majority of the upper surface of the lower part. In the latter case, a large lid would give a softer feel to a user handling the nozzle arrangement.

The second part of the nozzle arrangement may be completely separable from the first part. In such cases, the second part may be held to the first part by clipping onto the base. The clip may comprise one or more male projections provided on the abutment surface of one of said parts which are received within correspondingly shaped female holes or sockets provided in the other part.

Alternatively, the second part may be connected to the first part may be connected to the first part by a hinge which enables the abutment surfaces of the two parts to be brought together for use and separated for cleaning when desired.

A clip or an alternative securing means may also be provided to retain the first and second parts together.

In some embodiments the two-parts of the nozzle arrangement may be permanently welded together to provide a single unitary structure, especially if the rigid plastic of the first part is formed of the same or similar material to the second part. The weld could be formed by heat or an ultrasonic welding process.

The two parts may be moulded separately or, more preferably, as a bi-moulding on one machine.

Preferably, the abutment surfaces of the first and second parts additionally comprise a seal which extends around the internal passageway defined by the abutment surfaces as well as the outlet and the inlet defined

therebetween. The seal is preferably a horseshoe seal, similar to that described in WO 97/31841 and WO 01/89958 referred to above.

A portion of the seal may also extend across internal passageway thereby ensuring that the internal passageway is provided with an airtight seal when the nozzle arrangement is not in use. This would be particularly advantageous if the product passing through the nozzle is a product which is prone to degradation by air (such as creams or other food products) or products with a more watery consistency such as soaps or washing up liquids. How this seal may be achieved is described further below in reference to the figures.

In an alternative embodiment, the resiliently deformable wall of the internal passageway may be formed by providing the abutment surface of the second part with a ridge protrusion which is formed from a very thin section of a hardened moulded plastic which could be configured to function in the same manner as the resiliently deformable ridge. The thin plastic portion of the abutment surface of the second part which forms the ridge protrusion could be formed of plastic which is forced to mould into the desired shape so that when the abutment surfaces are brought together the thin plastic ridge fits closely into the groove on the abutment surface of the first part. The thin plastic wall of the internal passageway thus formed will resiliently deform when the nozzle arrangement is in use and return to its original moulded configuration when the nozzle arrangement is not in use.

The portion of the abutment surface of the first part which forms a wall of the internal passageway when the first and second parts are brought together may be a rigid flat surface instead of being provided with a groove as previously mentioned. Where the abutment surface of the first part is flat instead of provided with a groove, the resiliently deformable wall formed by the abutment surface of the second part of the nozzle arrangement would also be a flat surface rather than a ridge as previously mentioned. Accordingly, when the abutment surfaces of the first and second parts are brought into contact, a closed internal passageway is defined therebetween. In use, the pressure with which the contents of the container enter the nozzle arrangement through the inlet causes the resiliently deformable wall to deform away from the internal wall defined by the abutment surface of the first part thereby forming an open passageway through which the contents can flow to the outlet. After use, the resiliently deformable wall returns to its original configuration in which the internal passageway is closed.

The internal passageway may be of any suitable shape or configuration for the required purpose. In most cases it will be straight, but it could be curved or shaped or be spilt into one or more internal channels. If the product is intended to be ejected from the nozzle arrangement in the form of a spray, the internal passageway may additionally comprise one or more internal spray modifying structures, such as, for example, one or more expansion chambers,

inner orifices, venturi chambers, or swirl chambers. The effect of such internal spray modifying structures is described further in WO 01/89958.

If the product dispensed through the nozzle is a viscous liquid or foam, then the internal passageway could be made wider in the vicinity of the outlet to dispense the product in thicker portions (typically referred to as "slugs").

As previously mentioned, the internal passageway may still comprise some residual product in the internal passageway after use. It the product is extremely expandable, then it remains a possibility that some product may still leak out. For this reason, it will be necessary in some embodiments of the invention to provide a resiliently deformable wall which is configured to preferentially deform (i.e. without requiring the same level of pressure as the remainder of the resiliently deformable wall) in certain areas. Preferably, these preferentially deformable areas are displaced from the outlet so that any residual material that does remain in the passageway and does expand excessively will tend to cause these areas to deform so as to effectively provide an internal cavity which retains the product in the internal passageway and prevents it from leaking out through the outlet. Alternatively, or in addition to the preferentially deformable areas of the wall, the resiliently deformable wall could be provided with portions or areas near the outlet that are stronger, i.e. do not deform as readily as the remainder of the wall so as to provide a tight seal to prevent any expandable product leaking out when the nozzle arrangement is not in use and the internal passageway is closed.

In yet a further alternative embodiment, the resiliently deformable wall may be adapted so that its resilience/elasticity is greatest in the region of the internal passageway at, or near to, the inlet end of the internal passageway and the level of the resilience/elasticity may gradually decrease along the length of the passageway towards the outlet. This construction is preferred because, once the actuation of the release of the contents of the container has finished, the resiliently deformable wall then recoils to its original "non-deformed" configuration preferentially in the region at or near to the inlet and the force of recoil becomes gradually less towards the outlet end of the passageway. As a consequence, any product retained in the passageway is forced towards, and dispensed out of, the outlet in a continuous "flow-like" motion so that substantially all of the product retained in the internal passageway once actuation ceases is dispensed through the outlet. Any means of varying the resilience/elasticity of the resiliently deformable wall along the length of the passageway may be used. An example of one such means is where the thickness of the wall varies along the length of the passageway, i.e. it is thicker at, or nearer to, the inlet and becomes thinner, or the thickness tapers, towards the outlet.

In yet another alternative embodiment of the present invention, the resiliently deformable wall may be further adapted so that it comprises a manually-operable, resiliently deformable pump chamber, which can be operated by a person using the nozzle to effectively pump the contents of the

container through the outlet of the nozzle arrangement. In such embodiments, the product may be drawn into, and stored within, the resiliently deformable chamber through a one-way valve system provided at the inlet. The chamber may then be pressed or otherwise compressed so that the product stored therein is forced through the internal passageway and dispensed through the outlet of the nozzle arrangement. The flow of product back through the inlet into the container is prevented by the one-way valve. Once sufficient product has been dispensed through the outlet, or all of the product stored in the chamber is exhausted, the resiliently deformable wall of the internal passageway then returns to its original configuration in which the passageway is closed and more product is then drawn into the resiliently deformable chamber through the inlet until the chamber has deformed back to its original configuration.

The resiliently deformable pump chamber may be of any form, but is preferably a dome or similar shaped chamber formed on the upper surface of the nozzle arrangement where it is easily accessible for operation by a person using the nozzle.

Certain nozzle arrangements currently available are provided with a mesh positioned at or near the outlet. In such nozzle arrangements, the mesh could be formed from hardened material as usual and the resiliently deformable wall could extend right up to the mesh or, alternatively, the mesh could be made of resiliently deformable material by, for example, being moulded integrally with the second or upper part.

How the invention may be put into practice will now be described by way of example only, in reference to the following drawings, in which:

Figure 1 is a diagrammatic illustration showing a side view of a spray-through cap nozzle arrangement according to the present invention;

Figure 2A is a diagrammatic illustration showing a perspective view of the lower part 102 of the spray-through cap nozzle arrangement shown in Figure 1;

Figure 2B is a further diagrammatic illustration showing a perspective view of the lower part 102 of the spray-through cap nozzle arrangement shown in Figure 1;

Figure 2C is a line diagram showing the perspective view of the lower part 102 of the spray-through cap nozzle arrangement shown in Figure 2B;

Figure 2D is a further diagrammatic illustration showing a perspective view of the lower part 102 of the spray-through cap nozzle arrangement shown in Figure 1;

Figure 3A is diagrammatic illustration showing a perspective view of the upper part 103 of the nozzle arrangement shown in Figure 1;

Figure 3B is a diagrammatic illustration showing a perspective view of the upper part 103 of the nozzle arrangement shown in Figure 1;

Figure 3C is an end view of the upper part 103 of the nozzle arrangement shown in Figure 1.

In the following description of the figures, like reference numerals are used to denote like parts in different figures where appropriate.

Referring to Figure 1, a two-part spray-through cap nozzle arrangement 101 is shown which is adapted to be fitted to the end of a standard cylindrical aerosol canister (not shown). The spray-through cap nozzle arrangement 101 has a lower part 102 and an upper part 103. An outlet 104 is formed at the edge of the interface between the parts lower part 102 and the upper part 103.

During use, the upper part 103 is pressed downwards in the direction of arrow 105 to actuate the opening of an outlet valve on the aerosol canister and cause the contents of the aerosol to be dispensed through the outlet 104 of the nozzle arrangement 101.

Referring to Figures 2A, 2B, 2C and 2D, the lower part 102 has circular shaped base 201 which is configured to be fitted to the end of the standard cylindrical aerosol canister (not shown). The lower part 102 additionally comprises a centrally positioned actuator portion 202 which is connected to the base 201 by a connection portion 203 which flexible so as to enable the actuator portion 202 to move relative to the base 201. The lower surface of actuator portion 202 releasably engages with the outlet valve of the aerosol canister during use when the actuator portion 202 is pressed downwards in the direction of arrow 105 (Figure 1). As mentioned above, this causes the contents of the aerosol canister to be released through the nozzle arrangement 101.

The upper surface of the actuator portion 202 forms the abutment surface 204 of the lower part. Formed on the abutment surface 204 is a groove 205 which has an aperture 206 positioned at one end thereof. The aperture 206 aligns with the top of the outlet valve of the aerosol canister and forms the inlet of the nozzle arrangement 101 through which fluid the contents of the aerosol canister access the nozzle arrangement 101 during use. The groove 205 forms part of the wall of the internal passageway of the nozzle arrangement 101 and the opening 207 at the end of the groove forms part of the outlet 104 of the nozzle arrangement 101. Also present on the abutment surface 204 is a horseshoe-shaped recess 208 which encircles the aperture 206 and the groove 205. This horseshoe-shaped recess forms part of a horseshoe shaped seal in the nozzle arrangement 101, as explained further below in reference to Figure 3A. At the two ends of the horseshoe shape recess 208 are two holes 209 and 210. Alignment projections 211 are also formed on the abutment surface 204 of the lower part 102. The significance of the two holes 209 and 210 and the alignment projections 211 will be explained further below in reference to Figures 3A, 3B and 3C.

The upper part 103 of the nozzle arrangement 101 is shown in more detail in Figures 3A, 3B and 3C. Referring to Figure 3A, the upper part 103 has an abutment surface 305 which contacts the abutment surface 204 of the lower part 102 to form the final nozzle arrangement 101. To enable the upper part 103 to align with the lower part 102 so that the abutment surface 305 abuts

the abutment surface 204, the upper part 103 is provided with a wall 301 which is configured to fit around the edge of the actuator part 202 of the lower part 103. The appropriate alignment is further assisted by the protrusion rods 302 and 303 which, when the abutment surfaces are brought into contact, are received within the holes 209 and 210 of the lower part respectively, whilst the holes 304 of the upper part 103 receive the protrusions 211 provided on the abutment surface 204.

The abutment surface 305 of the upper part 103 is also provided with a ridge protrusion 306 formed of a resiliently deformable material which, in this embodiment, is a thin layer of moulded plastic. The ridge protrusion 306 forms the remainder of the wall of the internal passageway when the upper and lower parts are brought together to form the nozzle arrangement 101. Referring to Figures 3B and 3C it can be seen that the ridge protrusion 306 is provided a further protruding ridge 307 on the upper surface thereof. The ridge 307 assists in providing the necessary resilience to the ridge protrusion 306 so that it may deform during use of the nozzle arrangement and subsequently return to its original position when the nozzle arrangement is not in use. The ridge protrusion 306 is shaped to fit tightly into the groove 205 of the lower part 102 (i.e. so that the surface of the ridge protrusion 306 contacts the surface of the groove 205) when the upper and lower parts are fitted together to form the nozzle arrangement 101. When the upper and lower parts are fitted together fitted together, the ridge protrusion 306 resides along the entire length of the

groove 205. The effect of this configuration is that the internal passageway is closed when the nozzle arrangement is not in use. However, when the release of the contents of the aerosol canister is actuated, the pressure with which the contents access the nozzle arrangement 101 through the inlet 206 causes the wall of the internal passageway formed by the resiliently deformable ridge protrusion 306 to deform upwards, thereby opening the internal passageway and enabling the contents of the aerosol canister to flow through and be ejected through the outlet 104. In practice it is preferable that the ridge protrusion only deforms to approximately one third of the height of the channel 320 formed on the upper surface of the second part 103. This is to keep the height of the vertical channel between the top of the passageway and the top of the outlet valve (positioned directly below the aperture of the of the lower part 102) to a minimum and hence reduce the amount of product that may be retained in this vertical channel after use.

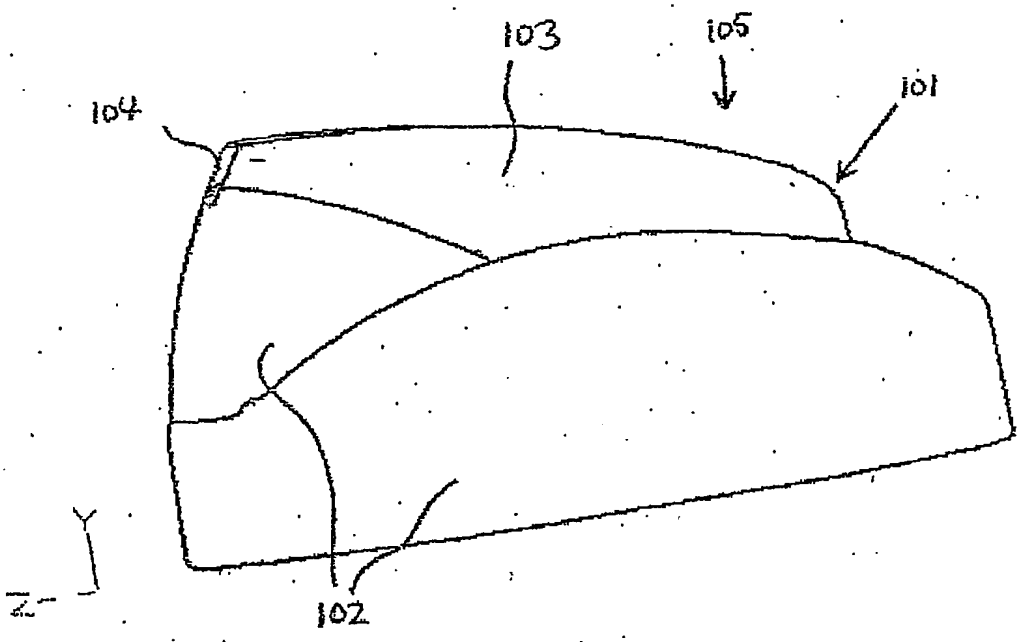
When the desired quantity of product has been dispensed through the nozzle arrangement 101, the actuation of the release of the contents is stopped by releasing the actuator portion and the resiliently deformable ridge protrusion then returns to its original position in which its surface contacts the surface of the groove 205. In doing so, the resiliently deformable ridge 306 forces any contents from the aerosol container that remain in the internal passageway to flow out of the outlet 104 or back into the inlet 206.

In an alternative embodiment, the ridge protrusion 306 is provided with a circular protrusion which, when the abutment surfaces 202 and 305 are brought into contact, is received within and "plugs" the inlet aperture 206.

To prevent any of the contents of the internal passageway from leaking and seeping between the abutment surfaces 202 and 305 during use, a horseshoe-shaped protrusion is provided on the abutment surface 305 which, when the abutment surfaces 202 and 305 are brought together, is received within the horseshoe-shaped recess 208 to form a seal which encircles the inlet and internal passageway of the nozzle arrangement 101. In an alternative embodiment, the seal may also extend across the internal passageway (i.e. the groove 205 may be provided with a recess extending across it width which receives a corresponding protrusion on the ridge protrusion 306, or vice versa) to provide an airtight seal when the nozzle arrangement 101 is not in use. The protrusion could be configured to snap-fit into the corresponding recess to form the seal. This may occur due to the elastic force with which the resiliently deformable ridge returns to its original position after use, or alternatively, an operator may have to press the protrusion into the recess.

It shall be appreciated that the description of the embodiment of the invention described in reference to the figures is intended to be by way of example only and should not construed as limiting the scope of the invention.

Figure 1



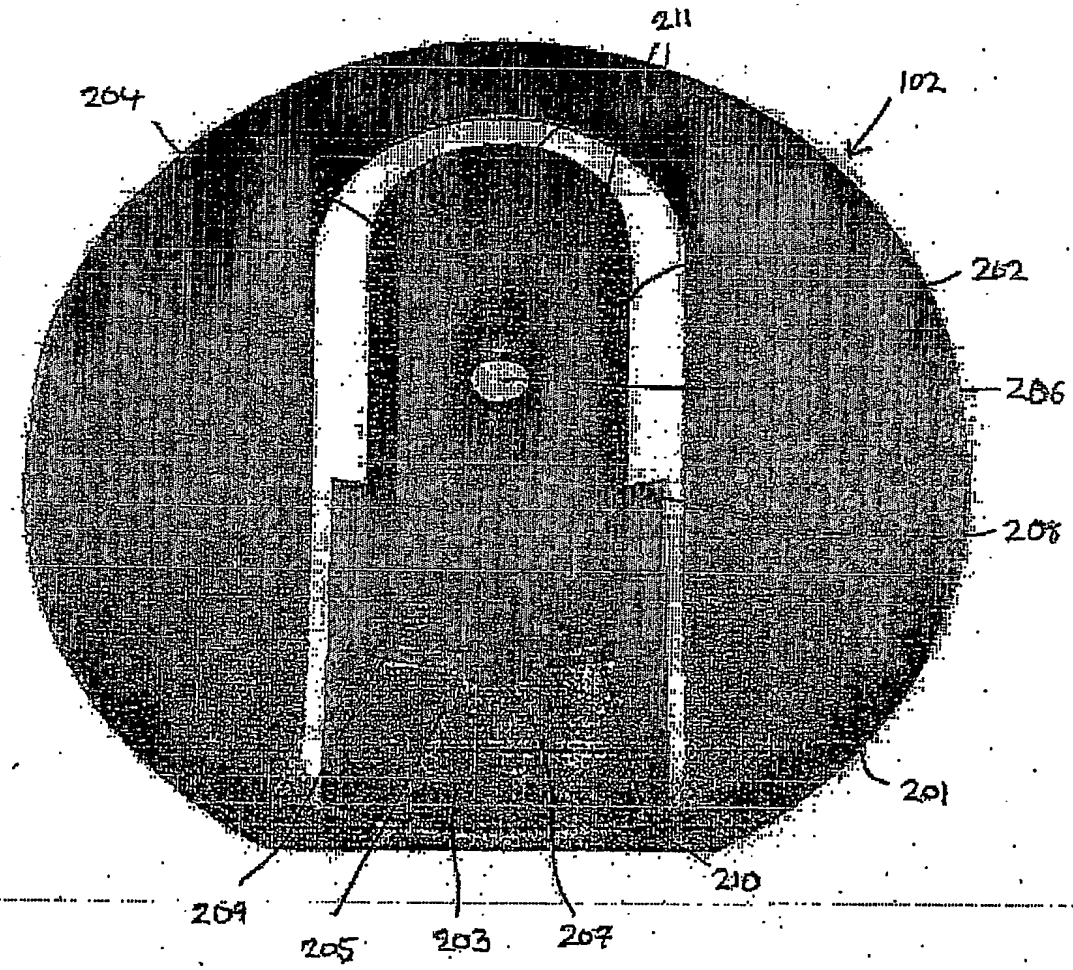


Figure 2A

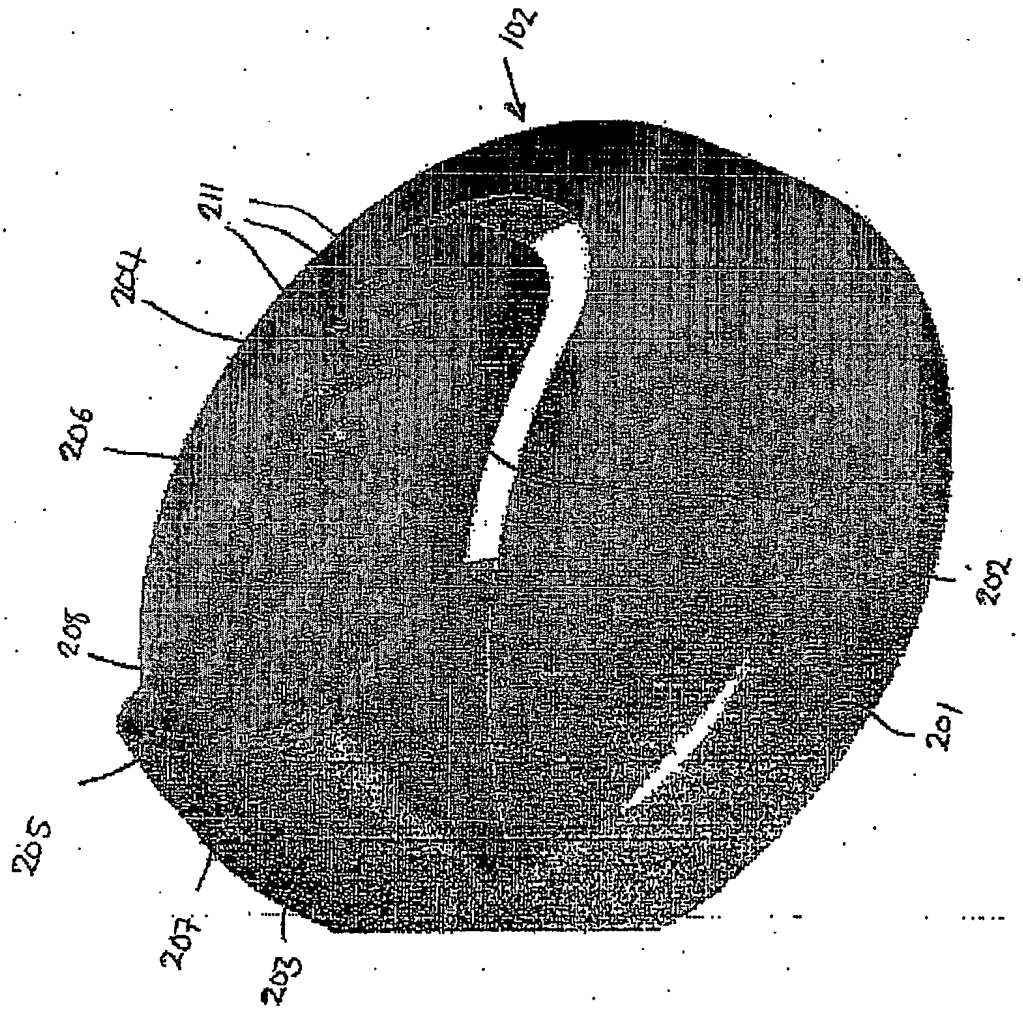


Figure 2B

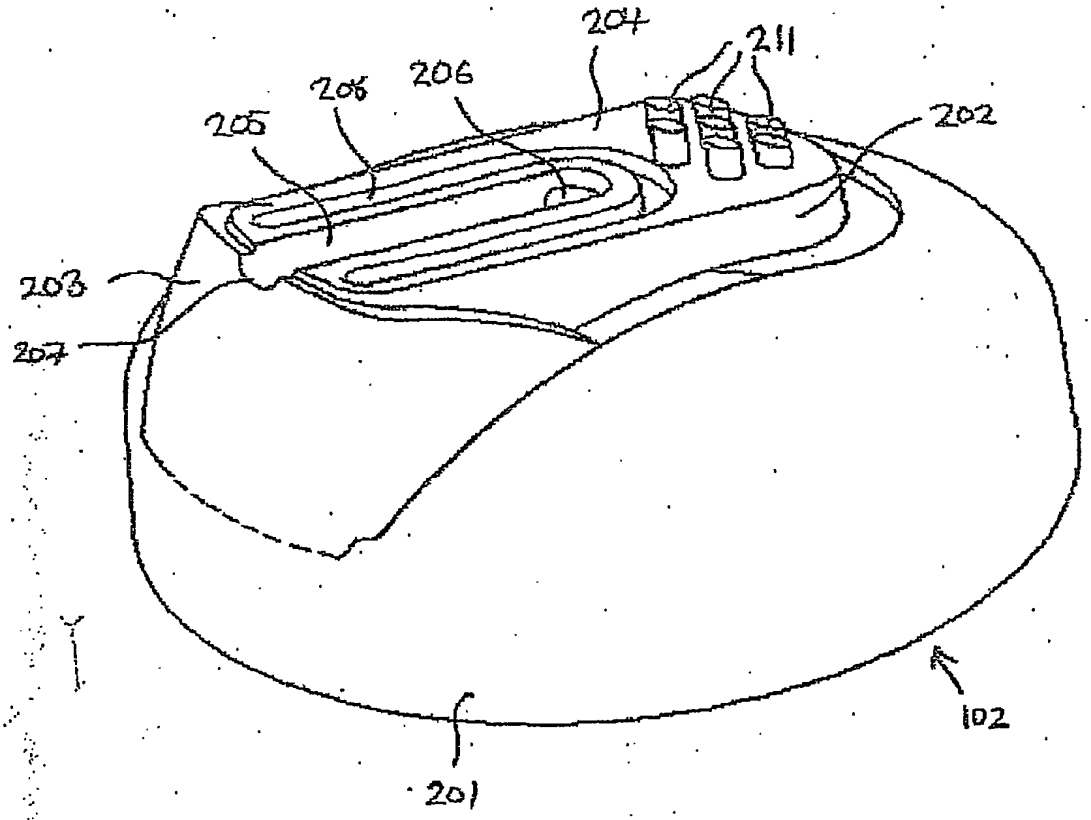


Figure 2C

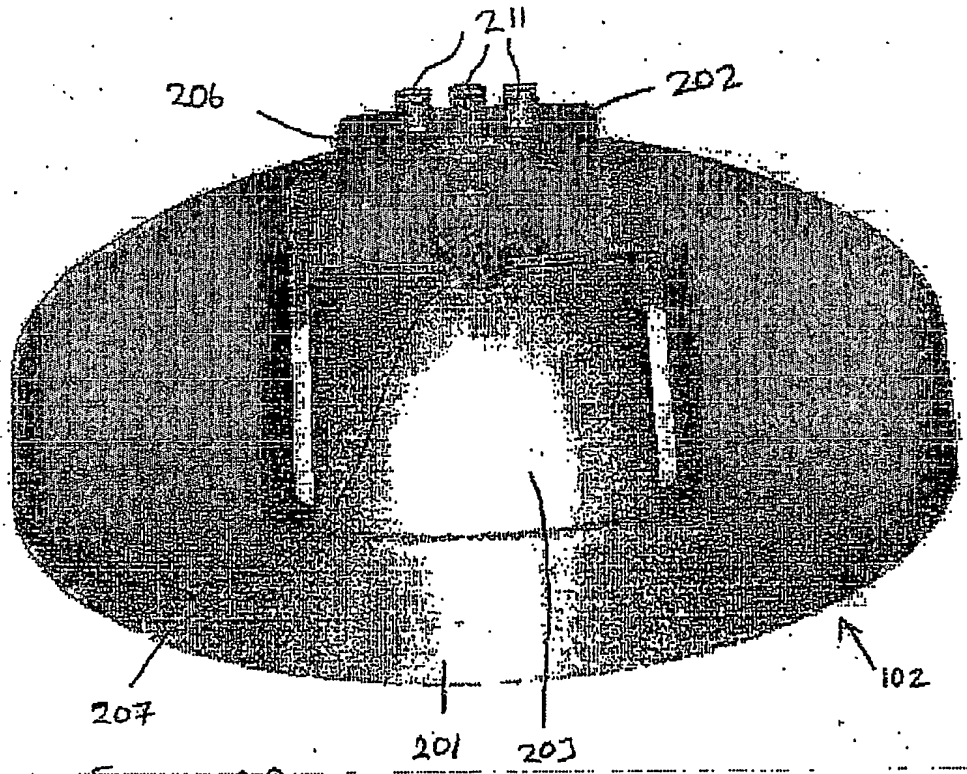
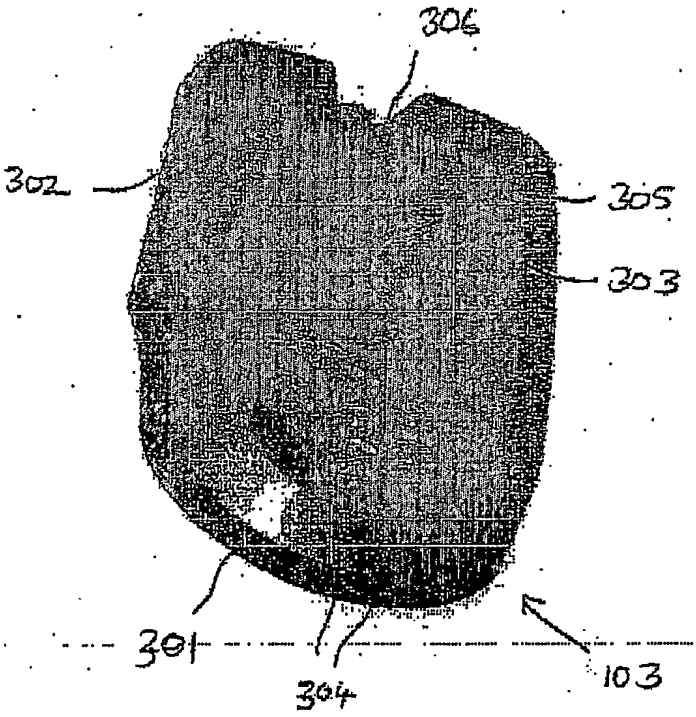


Figure 2D

Figure 3A



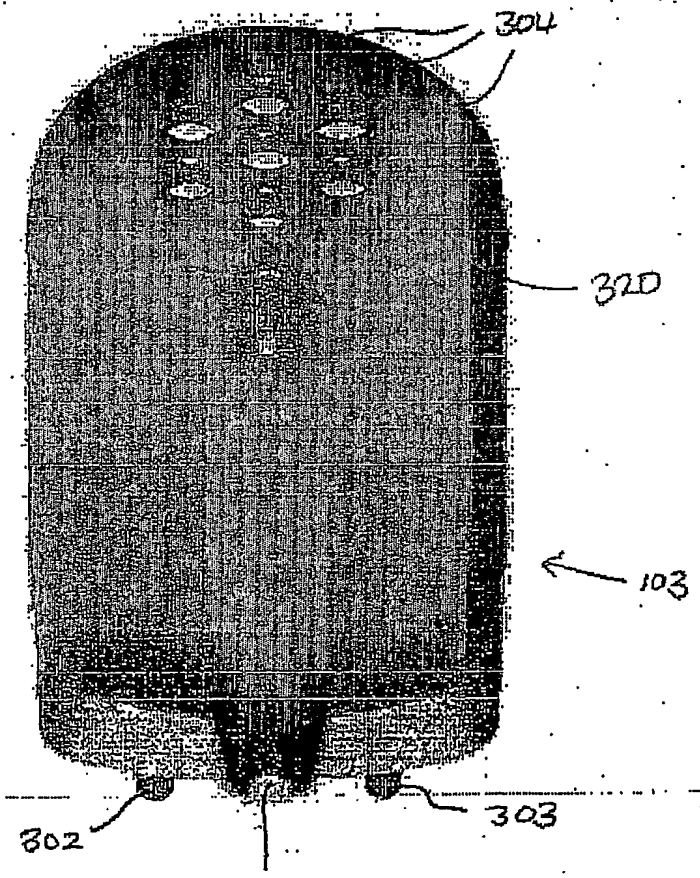


Figure 3B

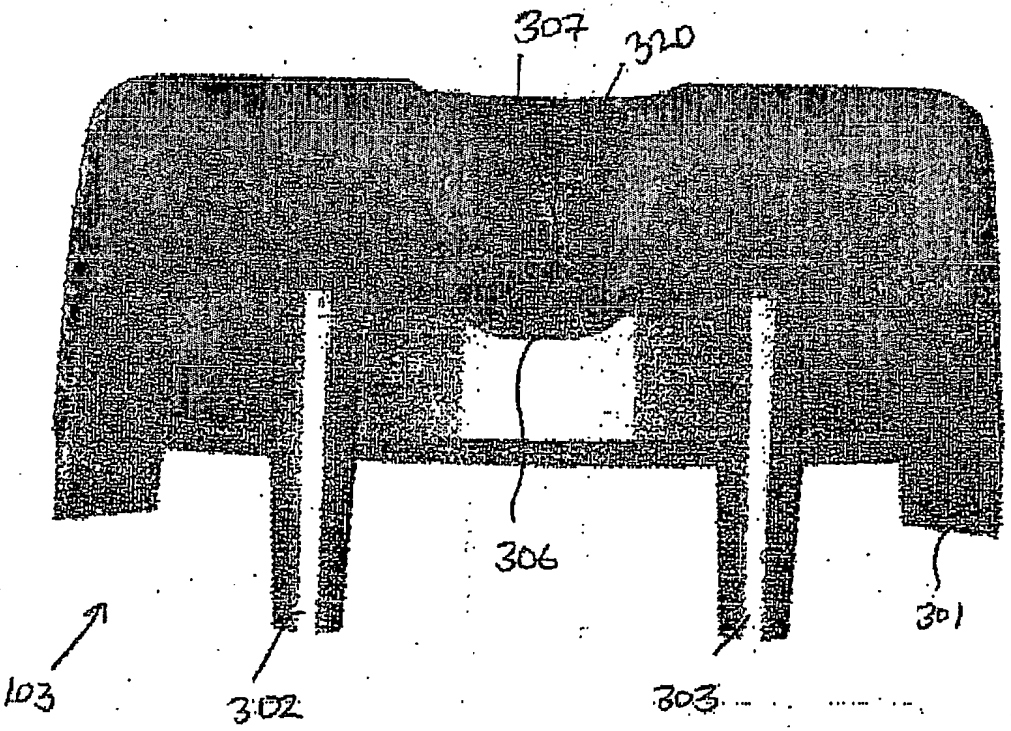


Figure 3C